REMARKS

In the Office Action, the Examiner rejected Claims 1-20, which are all of the pending claims, under 35 U.S.C. 103 as being unpatentable over U.S. Patents 5,513,029 (Roberts), 6,208,441 (Jones, et al.), and 5,777,773 (Epworth, et al.). Specifically, Claims 1, 2 and 18-20 were rejected as being unpatentable over Roberts in view of Jones, et al. and further in view of Epworth, et al; Claims 3, 7-11 and 15-17 were rejected as being unpatentable over Roberts in view of Epworth, et al; and Claims 4-6 and 12-14 were rejected as being unpatentable over Roberts in view of Epworth, et al. and further in view of Jones, et al.

The Examiner, in the Office Action, also rejected Claims 3-6, 11 and 18 under 35 U.S.C. 112 as being indefinite, objected to an informality in Claim 18, and objected to Figures 1-6.

Independent Claims 1, 3, 11 and 18 are being amended to better define the subject matters of these claims. Editorial changes are being made to Claims 4 and 18, and replacement sheets for Figures 1-6 are being submitted herewith.

More specifically, With respect to the drawings, the Examiner objected to Figures 1-6 as not being designated prior art, and the replacement sheets being submitted herewith are labeled "Prior Art." In view of this submission, the Examiner is respectfully requested to reconsider and to withdraw the objection to the drawings.

In addition, as the Examiner suggested, Claim 18, line 3 is being amended to change "optical signal" to "optical signals". Accordingly, the Examiner is asked to reconsider and to withdraw the objection to the language of Claim 18.

In rejecting Claims 3-6, 11 and 18 under 35 U.S.C. 112, the Examiner noted that Claims 3, 11 and 18 describe a set of signals or a set of optical signals, but argued that the specification describes a filter that passes one channel/wavelength signal. The Examiner argued that it is not clear whether the claims are intended to describe one or a set of channels/wavelengths.

Claims 3, 11 and 18 describe, and are intended to describe, a set of optical signals. Moreover, the specification expressly describes plural or multiple optical signals at several locations, including page 3, lines 14-21 and clearly shows a set of optical signals in Figures 1 and 2. It is noted that some parts of the specification describe how an individual signal is processed. These parts of the specification are describing how each one of the set of signals is processed. In view of the above, Claims 3-6, 11 and 18 are clear and definite and are consistent with the specification.

The Examiner also commented, in the Office Action, that there was no proper antecedent basis for "the passing step in Claim 4, or for "the step of using the filter output signals" in Claims 5 and 6. In response, Claim 4 is being amended to change "the passing step" to "the tracking step" which is set forth in the second last subparagraph of Claim 3, from which Claim 4 depends. With respect to Claims 5 and 6, Applicants note that the last subparagraph of Claim 3, from which Claims 5 and 6 depend, sets forth the step of "using the filter output signal," and this provides the appropriate antecedent basis for the reference in Claims 5 and 6 to "the step of using the filter output signals."

Applicants' Attorneys have carefully reviewed all of Claims 3-6, 11 and 18, and it is believed that these claims are clear and definite and fully comply with the requirements of 35 U.S.C. 112. The Examiner is, accordingly, respectfully asked to reconsider and to withdraw the rejections of Claims 3-6, 11 and 18 under 35 U.S.C. 112.

With regard to the rejection of the claims over the prior art, the Examiner, as indicated above, bases all of these rejections on the work of Roberts, either alone or in various combinations with Epworth and Jones. As explained below, there are a number of important differences between the present invention and the prior art, and all of Claims 1-20 patentably distinguish over the prior art and are allowable.

More particularly, the prior art of Roberts describes a method and apparatus for monitoring optical transmission systems by dithering the transmitted optical signal, tapping off and measuring both the dither and total optical power, and adjusting the relative signal power at each wavelength based on this information. The preferred embodiment of the present invention differs substantially from this patent, as follows:

In a wavelength multiplexed system, the preferred embodiment of this invention calculates the vector inner product of the filtered, dithered optical signal with the original dither reference. This calculation is not performed by Roberts; in fact, Roberts does not provide any connection between the original dither modulation signal and any other point in his apparatus (See Roberts Figure 2). This is a significant difference, which enables the preferred embodiment of the invention to be significantly more accurate than the prior art.

Further, Roberts estimates both signal and noise components for each wavelength signal in the optical network; this is not required by the present invention. Also, Roberts controls the optical power at each wavelength by direct modulation of the drive current in the semiconductor lasers; while the present invention preferably controls the optical power by adjusting the laser wavelength with respect to the transmission peak of an optical bandpass filter. Thus, Roberts does not control the laser wavelength at all using his approach.

Similarly, Roberts estimates the noise components in an optically amplified system and attributes part of these changes to laser wavelength drift effects (such as aging of pump lasers or malfunctions of temperature control devices). Roberts then attempts to correct for increased noise at the amplifier by compensating the amplifier gain. By contrast, the preferred embodiment of the present invention directly controls the center wavelength of each transmitter in a wavelength multiplexed network, and is thus capable of directly compensating for laser

wavelength drift by readjusting the laser center wavelength. In contrast with Roberts, there is no indirect noise estimation or gain compensation required by the present invention.

Roberts describes his dither as a pseudorandom signal that encodes a known modulation depth (See Roberts, col. 3, lines 39-40). For example, this signal may be a 64 kbps Miller encoded pseudorandom sequence which is bandpass filtered to pass components between 10 and 40 kHz (See Roberts, col. 3, lines 55-63). In contrast, the present invention preferably uses a periodic (preferably sinusoidal) dither modulation, which can be obtained from a single frequency oscillator, not an encoded pseudorandom signal.

Moreover, Roberts measures both the total optical power and dither amplitude of the tapped optical signals (See Roberts, col. 4, lines 38-41 and elsewhere). This calculation requires a microcontroller that correlates the encoded dither signal with various known pseudorandom digital sequences (See Roberts, col. 4, line 45-50). None of this is required by this invention, since it does not require encoding the dithered optical signal with any information and does not require direct monitoring of the tapped signal optical power.

Roberts requires a microcontroller for other applications as well (See, for example, col. 5, lines 25-26 and lines 36-40) as well as other apparatus for various embodiments including an optical chopper responsive to the microcontroller (See col. 5, line 30). None of this is required by this invention, which, in its preferred embodiment, uses a different approach (vector cross product modulation and feedback control of optical wavelengths).

Likewise, Roberts offers embodiments of optical amplifiers that must decode the modulated dither signal (See col. 5, lines 61-63). This is not required by the present invention.

Fundamentally Roberts does not in fact provide a means for wavelength locking, nor does he provide a correlation between the original dither signal and the modified dither signal further along the optical network, both of which are used in the preferred implemented of this invention.

Each of independent Claims 1, 3, 11 and 18 describes important features of the invention not shown in or suggested by the prior art. In particular, Claim 1 describes the feature that compensation for changes to the network configuration is made by adjusting wavelengths of optical signals transmitted through the optical filter bandpass with respect to a transmission peak of said filter bandpass. Similarly, each of Claims 3, 11 and 18 describes the feature that compensation for changes to the optical signals is done by adjusting the wavelengths of the optical signals with respect to a transmission peak of the filter bandpass.

As explained above, the procedure disclosed in Roberts does not operate in this way.

This feature also is not shown or suggested by either Jones, et al. or Epworth, et al. For example, Jones, et al. describes a wavelength division multiplex system in which wavelengths can be added or dropped. As signals are added and dropped, adjustments are made to achieve or maintain some preferred signal level.

Epworth, et al. discloses a method and system for controlling the frequency of a laser in an optical transmission system. In particular, the laser frequency is controlled on the basis of a determined phase quadrature.

Neither Jones, et al. nor Epworth, et al, however, discloses or suggests changing the optical wavelength by adjusting those wavelengths with respect to the transmission peaks of the filter bandpass, as described in Claims 1, 3, 11 and 18.

The other references of record have been reviewed, and these other references, whether considered individually or in combination, also do not disclose or suggest this feature of the invention.

Because of the above-discussed differences between Claims 1, 3, 11 and 18 and the prior art, and because of the advantages associated with these differences, Claims 1, 3, 11 and 18 patentably distinguish over the prior art and are allowable. Claim 2 is dependent from Claim 1

and is allowable therewith; and Claims 4-10 are dependent from, and are allowable with, Claim 3. Also, Claims 12-17 are dependent from, and are allowable with, Claim 11; and Claims 19 and 20 are dependent from Claim 18 and are allowable therewith. The Examiner is, thus, asked to reconsider and to withdraw the rejections of Claims 1-20 under 35 U.S.C. 103, and to allow these claims.

For the reasons set forth above, the Examiner is asked to reconsider and to withdraw the objection to the drawings, the objection to the language of Claim 18, and the rejections of Claims 3-6, 11 and 18 under 35 U.S.C. 112. The Examiner is also asked to reconsider and to withdraw the rejections of Claims 1-20 under 35 U.S.C. 103, and to allow these claims. If the Examiner believes that a telephone conference with Applicants' Attorneys would be advantageous to the disposition of this case, the Examiner is requested to telephone the undersigned.

Respectfully submitted,

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Enclosures: Replacement Sheets

IN THE DRAWINGS:

Applicants are submitting herewith Replacement drawings for Figures 1-6.